What is claimed is:

1. An intake air dehumidification system for an internal combustion engine, the system comprising:

an intake conduit having one end coupled to an intake manifold of the engine and an opposite end configured to receive ambient air;

a peltier junction device responsive to at least one control signal to cool, and therefore condense moisture from, ambient air supplied by the intake conduit to the intake manifold;

means for determining a specific humidity value corresponding to specific humidity of the ambient air supplied to the intake manifold; and

a control circuit producing the at least one control signal as a function of the specific humidity value to maintain the specific humidity of the ambient air supplied to the intake manifold near a target humidity value.

2. The system of claim 1 further including means for dissipating the moisture condensed from the ambient air by the peltier junction device.

3. The system of claim 1 wherein the means for determining a specific humidity value includes:

a temperature sensor positioned downstream of the peltier junction device and producing a temperature signal indicative of the temperature of the ambient air entering the intake manifold;

a pressure sensor positioned downstream of the peltier junction device and producing a pressure signal indicative of the pressure within the intake manifold; and

a relative humidity sensor positioned downstream of the peltier junction device and producing a relative humidity signal indicative of the relative humidity of the ambient air entering the intake manifold;

and wherein the control circuit is configured to produce the specific humidity value as a function of the temperature signal, the pressure signal and the relative humidity signal.

4. The system of claim 3 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device is positioned downstream of the compressor outlet.

5. The system of claim 3 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device is positioned upstream of the compressor inlet.

6. The system of claim 3 wherein the control circuit includes a closed-loop control strategy configured to produce an error value as a difference between the target humidity value and the specific humidity value, and to produce the at least one control signal in a manner that minimizes the error value.

7. The system of claim 6 wherein the control circuit includes a controller responsive to the error value to produce the at least one control signal.

8. The system of claim 6 wherein the control circuit includes a table mapping error values to corresponding control signal values, the table responsive to the error value to produce the at least one control signal.

9. The system of claim 1 wherein the means for determining a specific humidity value includes:

a temperature sensor positioned upstream of the peltier junction device and producing a temperature signal indicative of the temperature of the ambient air entering the intake conduit;

a pressure sensor positioned upstream of the peltier junction device and producing a pressure signal indicative of the pressure of ambient air entering the intake conduit; and

a relative humidity sensor positioned upstream of the peltier junction device and producing a relative humidity signal indicative of the relative humidity of the ambient air entering the intake conduit;

and wherein the control circuit is configured to produce the specific humidity value as a function of the temperature signal, the pressure signal and the relative humidity signal.

10. The system of claim 9 wherein the control circuit includes an open-loop control strategy configured to produce an error value as a difference between the target humidity value and the specific humidity value, and to produce the at least one control signal as a function of at least the error value.

11. The system of claim 10 further including a mass air flow sensor producing a mass air flow signal indicative of the mass flow of air past the peltier junction device;

and wherein the open-loop control strategy is further configured to produce the at least one control signal as a function of a product of the error value and the mass airflow signal.

12. The system of claim 11 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device and the mass air flow sensor are each positioned downstream of the compressor outlet.

13. The system of claim 11 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device and mass air flow sensor are each positioned upstream of the compressor inlet.

14. The system of claim 1 wherein the peltier junction device defines a cooling side and a heating side;

and further including a first heat transfer structure mounted to the cooling side of the peltier junction device and disposed in the flow path of the ambient air supplied by the intake conduit to the intake manifold, the cooling side of the peltier junction device and the first heat transfer structure cooperating to cool, and therefore condense moisture from, the ambient air supplied by the intake conduit to the intake manifold.

15. The system of claim 14 further including a second heat transfer structure mounted to the heating side of the peltier junction device and configured to direct heat away from the heating side of the peltier junction device.

16. The system of claim 15 wherein the intake conduit includes first and second separate airflow passages with the peltier junction device mounted therebetween with the cooling side in fluid communication with the first airflow passage and the heating side in fluid communication with the second airflow passage, the first airflow passage having one end coupled to the intake manifold downstream of the peltier junction device and an opposite end configured to receive ambient air upstream of the peltier junction device, the second airflow passage having one end configured to receive ambient air upstream of the peltier junction device and an opposite end vented to ambient downstream of the peltier junction device.

17. The system of claim 15 wherein the peltier junction device is mounted to the intake conduit with the cooling side in fluid communication with ambient air flowing through the intake manifold and with the heating side in fluid communication with ambient.

18. The system of claim 1 further including a moisture collection structure configured to collect moisture condensed from the ambient air supplied by the intake conduit to the intake manifold and to direct the collected moisture away from the ambient air supplied by the intake conduit to the intake manifold.

19. The system of claim 18 wherein the peltier junction device defines a cooling side disposed in the flow path of the ambient air supplied by the intake conduit to the intake manifold and an opposite heating side;

and wherein the moisture collection structure is configured to direct the collected moisture from the cooling side of the peltier junction device to the heating side of the peltier junction device.

20. The system of claim 19 further including a first heat transfer structure mounted to the cooling side of the peltier junction device and disposed in the flow path of the ambient air supplied by the intake conduit to the intake manifold, the cooling side of the peltier junction device and the first heat transfer structure cooperating to cool, and therefore condense moisture from, the ambient air supplied by the intake conduit to the intake manifold; and

a second heat transfer structure mounted to the heating side of the peltier junction device and configured to direct heat away from the heating side of the peltier junction device, the moisture collection structure extending from the first heat transfer structure at least to the second heat transfer structure to direct the collected moisture from the first heat transfer structure toward the second heat transfer structure.

21. The system of claim 20 wherein the moisture collection structure comprises at least one moisture absorbent member mounted to the first heat transfer structure and extending through the second heat transfer structure, the moisture absorbent member absorbing moisture condensed by the cooperation of the cooling side of the peltier junction device and the first heat transfer member and directing the absorbed moisture toward the second heat transfer structure for evaporation by the ambient air flowing past the second heat transfer structure.

22. An intake air dehumidification system for an internal combustion engine, the system comprising:

an intake conduit having one end coupled to an intake manifold of the engine and an opposite end configured to receive ambient air;

a peltier junction device responsive to a number of control signals to cool, and therefore condense moisture from, ambient air supplied by the intake conduit to the intake manifold;

means for determining a specific humidity value corresponding to specific humidity of the ambient air downstream of the peltier junction device; and

a control circuit producing the number of control signals as a function of the specific humidity value to maintain the specific humidity of the ambient air supplied to the intake manifold near a target humidity value.

23. The system of claim 22 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device is positioned downstream of the compressor outlet.

24. The system of claim 22 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device is positioned upstream of the compressor inlet.

25. The system of claim 22 wherein the control circuit includes:

means for producing an error value as a difference between the target humidity value and the specific humidity value; and

means for producing the number of control signals in a manner that minimizes the error value.

26. The system of claim 25 wherein the means for producing the number of control signals in a manner that minimizes the error value includes:

a controller producing a number of pulse width modulated output signals; and

a driver circuit responsive to the number of pulse width modulated output signals to produce the number of control signals, the controller controlling the pulse widths of the output signals as a function of the error signal to control the on-times of a corresponding number of peltier junction elements forming the peltier junction device.

27. The system of claim 25 wherein the peltier junction device includes a number of peltier junction elements;

and wherein the means for producing the number of control signals in a manner that minimizes the error value includes:

a table mapping error values to subset values corresponding to subsets of the number of peltier junction elements;

means responsive to the subset values to enable corresponding subsets of the number of peltier junction elements for operation; and

a driver circuit supplying the control signals to each of the enabled peltier junction elements to activate each of the enabled peltier junction elements.

28. An intake air dehumidification system for an internal combustion engine, the system comprising:

an intake conduit having one end coupled to an intake manifold of the engine and an opposite end configured to receive ambient air;

a peltier junction device responsive to a number of control signals to cool, and therefore condense moisture from, ambient air supplied by the intake conduit to the intake manifold;

means for determining a specific humidity value corresponding to specific humidity of the ambient air upstream of the peltier junction device;

a mass air flow sensor producing a mass air flow signal indicative of the mass flow of air past the peltier junction device, and

a control circuit producing the number of control signals as a function of the specific humidity value and the mass air flow signal to maintain the specific humidity of the ambient air supplied to the intake manifold near a target humidity value.

29. The system of claim 28 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device and the mass air flow sensor are each positioned downstream of the compressor outlet.

30. The system of claim 28 further including a turbocharger having a compressor defining a compressor inlet configured to receive ambient air and a compressor outlet fluidly coupled to the opposite end of the intake conduit;

and wherein the peltier junction device and mass air flow sensor are each positioned upstream of the compressor inlet.

31. The system of claim 28 wherein the control circuit includes:

means for producing an error value as a difference between the target humidity value and the specific humidity value; and

means for producing the number of control signals as a function of a product of the error value and the mass air flow signal.

32. The system of claim 31 wherein the peltier junction device includes a number of peltier junction elements;

and wherein the means for producing the number of control signals in a manner that minimizes the error value includes:

a table mapping error values to subset values corresponding to subsets of the number of peltier junction elements;

means responsive to the subset values to enable corresponding subsets of the number of peltier junction elements for operation; and

a driver circuit supplying the control signals to each of the enabled peltier junction elements to activate each of the enabled peltier junction elements.

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